fiscal impact model
part I: theory

the connecticut coastal area management program

Connecticut.

LOCAL FISCAL IMPACT MODEL

PART I: THEORY

Prepared for the
State of Connecticut
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Coastal Area Management Program
by
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P R E F A C E

This report was prepared by David J. Stockton under the supervision and guidance of the staff of the Connecticut Coastal Area Management Program. Mr. Stockton was an environmental intern with the CAM Program under the auspices of the Massachusetts Audubon Society's Environmental Intern Program. As a Danforth Fellow, he is working toward a doctorate in economics at Yale University. He received a B.A. and M.A. in economics from the University of Connecticut.

This report is designed to aid local decision-makers who must weigh many factors when considering economic development within their community. It focuses on one particular aspect of the development issue - the fiscal impact. This study presents a systematic structural framework for the collection, estimation and interpretation of the major local fiscal impacts generated by economic development. Views or opinions expressed herein are those of the author, and do not necessarily reflect the policies, official or unofficial, of the Connecticut Coastal Area Management Program or Advisory Board.

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INTRODUCTION

Local decision -makers must weigh many factors when considering development within their community. These factors can be complex and confusing, even to the experienced analyst. Often distorting the development issue are the polar views taken by various interests in the locality. Developers proclaim the employment, income and tax benefits of a project while those seeking a halt to development argue that it will increase local expenditure, degrade the environment or change the "character" of the community. A local offical must assess the validity of all such claims and make a decision that will provide the maximum benefit for the citizens of the community.

This report is designed to aid that decision-making process by providing a methodology to forecast one particular element of the development issue, the fiscal impact. Until recently it was assumed development necessarily provided a net benefit to the community in the form of jobs and tax revenues. This position, however, has not withstood careful examination; it may or may not provide a benefit to the town. This study presents a systematic structural framework for the collection, estimation and interpretation of the major local economic impacts generated by development.

Attempts have been made to avoid the biases that plague the information on which the local official normally bases his decision. The data developed by using this model is of a purely fiscal nature; other key factors such as the environment or social structure are not examined. It does not provide one final figure that definitively supports or rejects the project and is not intended as a cost-benefit analysis. The primary objective is the provision of a clear and simple set of data which the user can insert into the decision calculus. The decision-maker is not told which course of action to take but is presented with information as to some of the various relevant gains and losses resulting from development.

This study divides impacts into two major categories, private and public. The private impacts investigated are the income and employment generated by the development. The public sector effects will be examined in terms of the revenues and expenditures resulting from the new development's construction and operation.

There are two major aspects to a fiscal impact analysis. First, the economic effects occurring during a particular year must be identified and estimated. The impacts of a facility, however, are felt over many years. It will be necessary to compare and combine the effects across the span of time for which the facility is constructed and operated. The first section of this fiscal analysis will concentrate on the impact assessment for a single year. The second section presents a method for intertemporally aggregating single year impacts.

It is important to have accurate information for large scale developments, particularly along the coastal area. .There is growing development pressure along the coast annually. Should development be allowed to proceed based on false expectations or incorrect data, it is possible to lose the use of this scarce resource over a long period of time, or perhaps in perpetuity. The cost of a wrong decision in such cases can be severe.

The framework produced in this report, however, is relevant to all forms of economic development and in all geographic locations, not just the coastal area. All localities will want to base decisions affecting the fiscal and economic future of their communities on the best information available. This model should aid in the preparation of that information.

Regional economic theory is a relatively new field. It is possible that with greater time the tools described in this study can be refined and improved. Suggestions as to possible emendation are made in the appropriate sections.

Technical assistance in the interpretation and use of this model is available through the Coastal Area Management Program of the Connecticut Department of Environmental Protection and the Division of Economic Development Planning of the Connecticut Department of Commerce.

ANNUAL ANALYSIS

I. THE PRIVATE SECTOR

A. Primary Private Benefits

Primary benefits are those benefits produced directly by the construction and/or operation of the facility. Two major measures of primary benefits may be held important by a locality, income and employment. Both construction and operation create jobs and provide income. In most cases both of these items are available.

A locality may be interested in just a portion of the total employment and income generated by a facility. Specifically, a locality may be concerned only about the benefit accuring to those people residing within the town. In this case total employment and income must be pared to the fraction of local residents receiving the benefit. In order to estimate local employment and income it will first be necessary to derive figures for the total primary impact.

1. Total Employment and Income - The availability of this information is dependent upon whether: a) the analysis is being applied to a specific proposal or b) it is postulating the possible development of a facility.

   a. A Specific Proposal - If the analysis is being applied to a specific proposal the employment and income data should be readily available from the developer. This information should be collected by skill categories if possible.

   b. A Hypothetical Development - If the analyst is estimating the impacts from a hypothetical development two courses of action may be followed. Sometimes the analyst may hold *a priori* expectations about the size of the facility. For example, present resource estimates for the Georges Bank offshore oil development will constrain the size of the needed onshore facilities and suggest a probable size. The analyst should consult sources that have developed and gathered data on the facility in question. For information relating to Outer Continental Shelf energy facilities the Coastal Area Management (CAM) Program can assist the locality in obtaining viable sources of information on employment and income. CAM may also be able to provide information sources for other coastal-related industry.

      The Connecticut Department of Commerce staff has considerable expertise in industrial development and may be able to provide the planner with direct data or information sources. Consulting reports and the industries themselves can often provide valuable information.

If there are no expectations regarding facility size a crude method can be substituted. For a product with a national distribution and little or no production facilities within the state one can take the national average firm size to get an estimate of the number of employees. This information is available in County Business Patterns - U.S. Summary, published by the U.S. Department of Commerce.

County Business Patterns lists employment and payrolls by the Standard Industrial Classification (SIC). The SIC is listed by 2, 3 and 4-digit code. The 2-digit code is the most general grouping while the 4-digit code is the most detailed. For example, SIC 34 is fabricated metal products; SIC 344 is fabricated structural products; and SIC 3444 is sheet metal work.

The 4-digit code will provide the most accurate information on the facility in question. To avoid the disclosure of operations of individual firms, figures may not be available for the 4 or 3-digit code, thus forcing the use of the less accurate 2-digit information.

Given a product the state has had extensive experience producing, a better estimate may be obtained by using the average firm size in the state. This time the information can be found in County Business Patterns - Connecticut.

Income figures for the firm may also be developed, if not given. The best method is to determine the average state wage for the industry and apply it to the expected employment. The following is the specific procedure:

$$(1) \quad Y_f = E_f \times \frac{Y_t}{E_t}$$

where,

Y_f = firm payroll
E_f = firm employment
Y_t = total wages and salaries for the industry in the state
E_t = total industry employment in the state

It should be noted that the payroll figures reported in the County Business Patterns are in some noted instances quarterly and thus must be quadrupled to annualize the data.

2. Local Employment and Income - The labor comprising total employment can be broken down into three sources, local labor, non-local regional labor and in-migrating labor. Figure 1. may help clarify the meaning of these terms.

Local labor, L, lives in the community and works at the facility; the locality being represented as the center circle. The region, as a whole, is represented by all that is contained within the second circle. Non-local regional labor, R, works at the facility but lives in the surrounding communities; these persons live in the ring, between the inner and outer circle, and commute to work in the locality. In-migrating labor, M, moves into the region or locale to work at the facility. It will be assumed here that the local analyst will be concerned with determining L, the local residents finding jobs at the facility. The exact relationship of these variables is:

$$(2) \quad L + R + M = T$$

where,

L = local labor
R = non-local regional labor
M = in-migrating labor
T = total employment

This section will discuss the estimation of local employment and income.

a. A Specific Proposal - The developer should provide two critical figures, the total employment, discussed in the previous section, and the number of workers in-migrating. The management positions and labor with highly specific skills are often brought in with the facility. In addition, facilities with large labor forces often provide the impetus for some relocation of the general work force into the region.

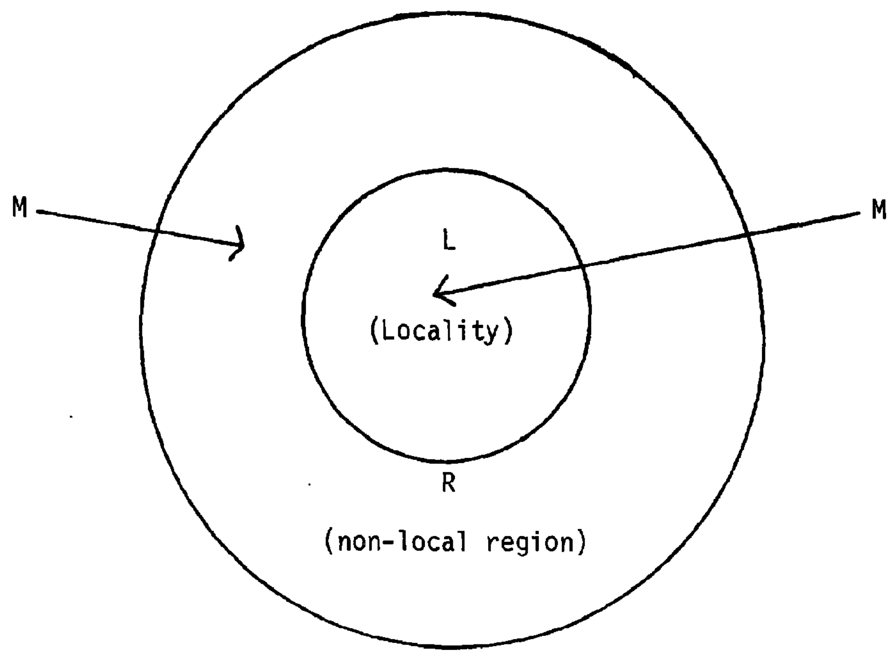

FIGURE I

Sources of Labor

L = Local Labor
R = Non-local regional labor
M = In-Migrating labor

Given T and M, the sum of local and non-local regional employment is determinant:

$$(3)\quad L + R = T - M$$

For state and regional officials it is (L + R) that is the relevant figure for employment impacts. The local analyst, however, must make a final estimate of the breakdown between local and non-local regional labor if a final estimate is to be made of just the local benefit.

A method does not exist that can predict with certainty the residence of the people hired by the facility management. The following method relies on the analyst's judgement but requires an explicit statement of that judgement. The first step involves estimating local labor demanded; that is the amount of labor that would be hired from the locality should the local supply exist. The labor demand is then compared to the actual supply to make the final estimate of labor hired locally.

Local labor demand is calculated as:

$$(4)\quad L_d = \gamma(T\text{-}M) = \gamma(L\text{+}R)$$

where,

L_d = local labor demand
γ = the percentage of facility employment, excluding the in-migrating workers, demanded from the local labor force.

In order to calculate local labor demand, parameter γ must be assigned to a value. We know that (T-M), which is equal to (L+R), represents the number of jobs to be filled by residents of the region as a whole. This must be divided into jobs for residents of the locality and jobs for residents of the non-local region. For example, if γ is set equal to 0.5 this will imply that 50% of the jobs, excluding those going to in-migrating workers, are open to local residents. This does not mean that 50% of the jobs will ultimately be filled by local residents. If local labor demand, L_d = 0.5 (T-M), should exceed the number of local residents seeking employment the excess demand may then be filled by workers in the surrounding localities, or the non-local region, as it is termed in this model.

The coefficient γ can be estimated in several ways. If the developer has agreed to consider local residents as a top priority in hiring the γ may be close to 1.0, depending on the skills of the local labor force. This implies 100% of the jobs will be open to local residents. Again, should the demand exceed the local supply, the excess may be filled by workers from surrounding localities. If local residents are shown no favor in hiring, and thus have the same probability of being hired as all the other regional residents, then γ may be the percentage of the regional unemployment that the locally unemployed comprise. For example if:

regional residents seeking employment = 1000

local residents seeking employment = 50

then,

$$\gamma = \frac{50}{1{,}000} = 0.05$$

Other factors may influence the choice of γ. If the local labor force has had experience with similar developments in the past the demand may be focused closely on the community, i.e. a larger value. On the other hand a previously rural community may find the facility managers looking outside of the community for the bulk of their employment, and thus the analyst should reduce γ.

The parameter should also involve consideration of the non-local regional labor force. A highly skilled labor force in the non-local region will lower the γ for the locality where the facility is built while an unskilled rural labor force in the non-local region may raise the value of the parameter.

It should be stressed that γ is a subjective parameter. It forces an explicit statement of the analyst's assumption regarding employment in the locality. Estimation of local employment benefits should perhaps be made using a range for γ in the analysis to reflect its uncertain value.

Once this coefficient has been established the local demand can be calculated. The local benefit will be the number of local residents demanded that actually fill positions. If the demand for local laborers exceeds the number of local laborers seeking employment then the employment benefit will be equal to the number of local residents seeking work. Should demand for local workers fall short of the number of local workers seeking jobs the local employment benefit equals the demand for local workers.

Estimation of local income follows the same procedure as local employment.

b. A Hypothetical Development - In order to estimate local employment and income it will again be necessary to know total employment and in-migration. A method for determining total employment was previously developed in Section I.A.1.b. The same sources should be consulted for in-migration generated by a hypothetical facility. These are: 1) Coastal Area Management Program, (for OCS and marine oriented industry), 2) Connecticut Department of Commerce and, 3) the industry being studied.

If no data exists on possible in-migration the analyst should make an estimate. All management positions and that labor needed with skills not held by the regional labor force should be expected to move into the region.

This returns us to the discussion of allocating regional employment needs between local and non-local workers. Once again we use:

$$(4) \quad L_d = \gamma\ (T - M)$$

to estimate local employment demand. The same procedure should be followed to determine the final local employment impact.

Income projections will again follow the estimation of local employment.

B. Secondary Private Benefit

1. The Multiplier Effect - The economic impact of a development will be greater than just the direct primary impact. The income earned by employees of the facility will be disposed of in several ways. A portion of the income will be saved and a portion taxed away. Income will also be used in the purchase of goods and services from outside the community. In these ways income "leaks" out of the locality. A final portion of the income will be spent within the local economy.

This becomes some other local residents' income and is spent again, with part leaking out and part remaining in the system. Successive rounds of spending magnify the original injection of income in the economy. This is known as the multiplier effect. This secondary impact increases both income and employment.

2. The Economic Base Method - From economic theory there are several possible methods that can be used to measure these secondary flows. The choice of a method will depend largely upon the availability of data with which to estimate the multiplier. For this analysis the economic base method will be utilized. The basic method has performed well in past empirical research.

   The major principle upon which the theory is based is that growth in a local (or regional) economy is dependent upon basic industries that allow for the importation of income. The greater the level of imported income the greater the ability to stimulate activity in the service, support, and consumer sectors. This is further intensified by the multiplier effect with the successive rounds of spending. The industries importing income are called basic industry.

   The non-basic sector supplies services only to the local economy. Housing, grocery stores, retail stores and medical services are but a few non-basic activities.

3. Employment and Income Multipliers - A distinction should be made between income and employment multipliers. While the general concept is the same for both, the economic factors affecting their empirical composition are somewhat different.

   An income multiplier is sensitive to the propensity to consume local goods while an employment multiplier is additionally sensitive to the elasticities of supply and demand in the labor market.

   The economic base method can be used to derive both multipliers but the data base must be consistent; use all income figures when developing an income multiplier and all employment data when deriving an employment multiplier. The analyst may use either or both depending on the needs of the particular study.

4. The Theory - In order to understand the computational method involved in deriving the basic multiplier it will be necessary to explain its theoretical background. The theoretical constructs of the model can be interchangeably explained in terms of income or employment but it should again be stressed that they require separate estimation. We begin the theory with a simple definition:

$$(5) \quad T = B + NB$$

where,

T = total income (or employment)
B = basic income
NB = non-basic income

The crucial assumption of the basic theory is:

$$(6) \quad \frac{T}{B} = \lambda$$

where,

λ = a constant

This implies the ratio of total income to basic income remains constant. For example, if $\lambda = 2$ this would imply that \$10 of the basic income could support \$20 of total income. An increase of \$5 in the basic income would therefore produce a \$10 increase in total income. This indicates that non-basic income has risen \$5:

$$(7) \quad \Delta T - \Delta B = \Delta NB$$

$$\$10 - \$5 = \$5$$

For the basic method to yield accurate estimates of the secondary impacts the relationship between total and basic income must be stable. This has been a good assumption for communities not undergoing any radical structural changes.

Once the relationship has been established and is determined a simple manipulation places the equation in a functional form.

$$(8) \quad \Delta T = \lambda \Delta B$$

Once λ is estimated it will only be necessary to calculate the change in basic income, ΔB, from a development to estimate the entire secondary flow.

5. <u>The Geographic Scope of the Multiplier</u> - Theoretically a multiplier can be derived for any size region. The smaller the region the greater the leakages of income out of the economy and thus the smaller the multiplier. Beyond the theory there are practical considerations which should be weighed in determining the geographic scope of the multiplier.

The first problem with the use of local data is that it rarely exists in detailed enough form. The Connecticut Department of Labor's Research and Information Division collects data on employment in the State's localities. In order to avoid disclosing the size of individual firms the data they provide must be highly aggregated into broad employment categories. The categories can be related to SIC groupings, although not directly to the SIC digit code. This level of aggregation hinders the accuracy of the determination of basic and non-basic industry.

A second problem with the use of local data is concerned with regional cross flows of spending. Local political boundaries have very little to do with the delineation of economic boundaries. A community may have high levels of non-basic employment, relative to basic employment, which is generated by high levels of basic employment in adjacent towns. This would tend to lead to an overestimate of the local multiplier. The relationship between total and basic employment may be weakened at the local level.

The larger the local economy the less of a problem are the factors mentioned above. For an urban economy which has maintained detailed employment and/or income data by SIC code the use of local data is not only feasible but is actually desirable.

For smaller communities the use of county data is a viable alternative. A multiplier is developed which estimates the secondary impact for the county. A portion of the secondary impact is then allocated to the locality based upon its importance in the county economy. A method for this allocation is discussed below in Section I.B.8.b. County data is available at the two-digit SIC level and is therefore directly compatible with the national data. The economy of a county is also large enough to capture the secondary impacts and fit the assumption of a stable relationship between total and basic employment. The drawbacks to this method are mentioned below in Section I.B.8.b.

The derivation of a county multiplier proceeds in a fashion identical to that of the derivation of a local multiplier. In the discussion below one should just replace local data with county data if a county multiplier is to be derived.

Even if county data is to be used it may be helpful to acquire the local employment data from the Department of Labor's Research and Information Division. This information may be useful in setting the γ coefficient, discussed in the previous section, by examination of the locality's industrial experience.

6. Determining Basic Industry - The first step in applying this theory to a practical situation will be separation of total income into their basic and non-basic components. This is a relatively simple task. The use of a location quotient can quickly indicate the type of activity performed. The concept underlying the location quotient is that if a town has a higher percentage of its employment devoted to an activity than the nation then it must be exporting a portion of that production, and therefore is an activity defined as basic. For example, if a community devotes 30% of its employment to the production of submarines while the national average is 0.5%, it is likely that the community is exporting submarines. This bars the possibility of the community residents having peculiar consumption habits with respect to submarines. The location quotient is a convenient tool to detect this event. It is written as:

$$(9) \quad L_i = \frac{\frac{e_i}{e}}{\frac{E_i}{E}}$$

where,

L_i = location quotient for the ith industry
e_i = local employment (or income) in the ith industry
e = total local employment (or income)
E_i = national employment (or income) in the ith industry
E = total national employment (or income)

Thus if L_i is greater than one the proportion of local employment engaged in industry i is greater than the national average and thus industry i exports some portion of its product. Should L_i be less than or equal to one the industry is non-basic and thus is insufficient or just able to meet the requirements of the locality.

At this point two possible routes may be followed. One method takes all the employment in the industries with location quotients greater than one and classifies it as basic employment leaving the remainder as non-basic.

An obvious problem with this method is that some of the employment in the industries that will be classified basic will serve the local population. A location quotient of 1.3 really means that 30% more income is earned in industry i than the national average for industry i and thus only 30% should be apportioned to the basic employment category. Some economic research has indicated that this method will have a negligible detrimental effect on the results and therefore is a viable system. (For a discussion of both sides of this issue see: G.E. Thompson, An Investigation of the Local Employment Multiplier, Review of Economics and Statistics, 41, pp. 61-67 (1959) and P.E. Polzin, Urban Employment Models: Estimation and Interpretation, Land Economics, 49, pp. 226-235 (May 1973).)

The second method addresses itself specifically to this problem. It will define basic employment as only that portion of employment producing the good over and above that needed to satisfy local demand. To arrive at that figure the following formula is used:

$$(10) \quad B_i = e_i - \frac{E_i}{E} e \text{ for } B_i \geq 0$$

where,

B_i = basic employment in industry i

The interpretation of this equation is relatively simple; $\frac{E_i}{E}$ is the national proportion of income earned in industry i and thus $\frac{E_i}{E} e$ is income that would be earned if the locality produced just enough of the product of industry i to meet their needs, according to the national average. Since e_i is the actual income earned in this sector the difference between e_i and $\frac{E_i}{E} e$ must be that employment devoted to export and thus basic activity.

This process must be repeated for all industries, normally by SIC, in the town. Basic employment or income is then summed. It should be stressed again that if secondary flows of income and employment are to be estimated, this process must be performed with income and employment data, respectively.

7. Calculating the Multiplier - The multiplier can be directly estimated given data that is broken down into total and basic income or employment. Two possible methods will be presented here for the estimation of the multiplier.

The first method just involves the formation of the ratio of total to basic income for several time periods:

$$(11)\quad \frac{T_1}{B_1} = \lambda_1,\ \frac{T_2}{B_2} = \lambda_2 \ldots,\ \frac{T_i}{B_i} = \lambda_i,\ \ldots\ \frac{T_N}{B_N} = \lambda_N$$

where,

T_i = total employment in period i
B_i = basic employment in period i
λ_i = multiplier in period i

The analyst then just averages the λ_i through λ_N. The average, λ, represents the estimated multiplier. The greater the number of time periods used the more accurate will be the estimate of the multiplier.

The best estimation form of the simple economic base method would entail the use of a simple linear regression of the form:

$$(12)\quad T_t = a + \lambda B_t$$

where, T_t = total employment in time t

B_t = basic employment in time t

In this case λ is the estimated regression coefficient and will be the multiplier. The regression technique is useful only if there has been substantial variation in total and basic employment. Also the procedure will give definitive results only if there is an adequate sample size. For example, it would be difficult to get good results with a sample size under ten. The great advantage of the regression analysis is that "substantial", "adequate" and "accurate" can be judged in terms of the summary statistics from the regression. It is also a more costly and time consuming method.

8. Estimating the Local Secondary Flow - Once λ has been estimated the final step can be taken in secondary flow estimation. The basic employment of the new facility needs to be estimated. Should the analyst use the first method of Section I.B.6. to determine basic industry, all primary income will be considered basic. The use of Equation (10) would determine the proper level of basic employment, ΔB, if the second method is used. With ΔB and λ determinant we know we can estimate ΔT by:

$$(8) \quad \Delta T = \lambda \Delta B$$

Non-basic activity will simply be:

$$(7) \quad \Delta T - \Delta B = \Delta NB$$

If local data was used then ΔNB represents the increase in non-basic activity within the locality. If county data was used then Δ represents the secondary flow within the county. From this point two slightly different techniques must be developed for the methods using local and county data respectively.

a. The Local Data Method - For the local data case ΔNB represents the secondary employment (or income) gained by the locality. It does not, however, strictly represent the employment of local residents. The employment earned within the locality must again be separated into a portion filled by local residents, non-local regional residents and inmigrating workers. This distributional problem is more complex for secondary flows than for primary flows.

Just as with the primary employment, this secondary employment will also generate in-migration to the region. There are two possible methods for estimating this secondary in-migration. The first would involve surveying local employees of non-basic businesses. The survey would ask employees whether they had moved to the region to get the job that they how hold. The percentage of non-basic employees who in-migrated, Θ, is then applied to the estimated increase in non-basic employment to estimate the associated in-migration.

If the survey method is not felt practical the analyst will be forced to make a judgement about the percentage of labor in-migration. The analyst should assign Θ a range of values; that is estimate labor in-migration. For most localities 10% to 20% will be a reasonable range. Should the analyst have more specific information about or experience with the community, a different range for Θ can be established with justification for the estimate.

After establishing the percentage of non-basic employment that in-migrates to the region, Θ, one must apply it to the secondary flow estimated in this section to determine the proportion of jobs filled by labor that comes from outside the region. This quantity should be subtracted from the total estimated secondary flow. This leaves the secondary flow going to local and non-local regional residents; which is the number of secondary jobs held by residents of the locality and the region. Algebraically:

$$\Delta NB - \Theta \Delta NB = \Delta NB_r \quad \text{so,}$$

$$(13) \quad (1-\Theta)\, \Delta NB = \Delta NB_r$$

where,

ΔNB = total change in non-basic employment

Θ = the percentage of non-basic employment in-migrating to region

$\Theta\Delta NB$ = non-basic employment in-migrating to region

ΔNB_r = the change in non-basic employment for local and non-local regional residents

This method will establish secondary employment for the region, but the intra-regional location problem still exists; we do not know whether the secondary employment will be taken by local residents or non-local (regional) residents.

The secondary effect of the facility does not stop at the boarder of the town. Figure 2 demonstrates the possible labor flows due to the secondary effects.

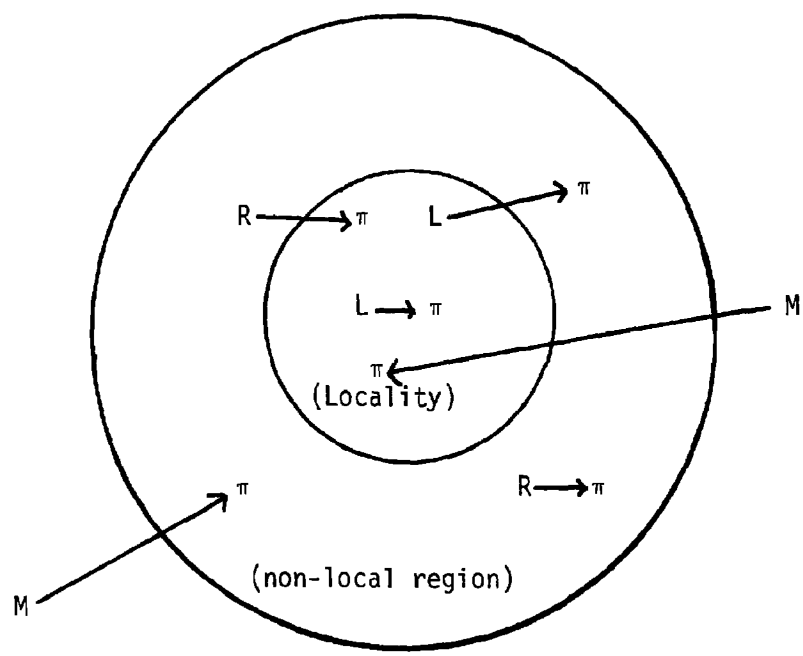

FIGURE 2

MOVEMENT OF LABOR

L = Local labor
R = Non-local regional labor
M = In-migrating labor
π = Secondary employer

The multiplier effect is also creating jobs in the region. This means jobs will also be created in the region beyond just those in the locality under investigation. It is therefore possible that local residents, L, may seek not only the secondary jobs within their town but also those in other areas of the region. While this occurs, non-local regional residents, R, seek employment within the locality. So there are local residents seeking secondary jobs in the non-local region and there are non-local regional residents seeking jobs in the locality.

Estimation of these cross flows at this level of analysis would not be a meaningful task. In most cases it is likely that the cross flows will come close to cancelling each other. Thus the analysis will not be biased if the local secondary flows, net of in-migration, are counted as a local benefit. The analyst, however, should be cognizant of this assumption.

One major condition must still be met. The number of local residents seeking jobs, after the direct jobs have been filled, must be sufficient to fill the secondary job openings. If the number of residents seeking employment falls short of the number of openings, the secondary benefit will only be that income or employment going to the local residents and should not include jobs or income going to in-migrants or commuters.

b. The Use of County Data - County data on both income and employment can be found in the volumes of County Business Patterns - Connecticut published by the U.S. Department of Commerce. Proceeding as described in Section I. B.7., the multiplier is developed for the county. Applying the multiplier to the increase in basic employment generated by the facility we have:

$$(14) \quad \Delta T_C = \lambda_C \Delta B_C$$

where,

ΔT_C = change in total county employment
λ_C = county basic multiplier
ΔB_C = change in basic county employment

Again the secondary flows are estimated:

$$(15)\quad \Delta T_C - \Delta B_C = \Delta NB_C$$

where,

ΔT_C = change in total county employment
ΔB_C = change in basic county employment
ΔNB_C = change in non-basic county employment

This is the secondary, non-basic, activity generated for the entire county.

It remains to be estimated just how much of this non-basic development will take place in the community under study. It is assumed here that the community will have an increase in non-basic employment in proportion to its percentage of county employment. Thus, the change in local non-basic activity can be calculated as:

$$(16)\quad \Delta NB_C \frac{T_L}{T_C} = \Delta NB_L$$

where,

T_L = total local employment
T_C = total county employment
ΔNB_L = change in local non-basic employment

When using this method the analyst must again estimate the portion of NB_L that will be gained by persons in-migrating to the region. The same method is used here as was used in Section I.B.8.a. We form the equation:

$$(17)\quad (1 - \Theta)\ \Delta NB_L = \Delta NB_r$$

The final result is ΔNB_r, the employment and/or income earned by residents of the region at jobs within the locality. Again we make the simplifying assumption that this is all local benefit; the regional cross flows depicted in Figure 2 are ignored.

This method may tend to underestimate the secondary impacts within the locality, since it is given no weight as being the location of the development. This under-estimate, however, will not be significant unless the entire character of the local economy changes.

C. Total Local Private Benefit - The model has now estimated the primary and secondary income and employment to be earned by community residents. The local analyst will be concerned with the total local private benefit.

Total local private benefit is the simple combination of primary and secondary impacts. Total local employment is the sum of local primary employment and local secondary employment while total local income is the sum of local primary income and local secondary income.

D. Opportunity Cost - The calculation of total local benefit from a development may not be a complete measure of private local benefit. Certain activities or land uses must cease when the facility is constructed.

Up to this point in the analysis all jobs and income earned by local residents have been considered a benefit. This is true if the local residents receiving jobs were previously without jobs. The local analyst will be concerned with the increase in employment and income within the community. If employed persons leave their present work to take jobs opened by new development an increase in benefit may or may not have occurred. If the job vacated is not refilled, or is refilled by a non-local person there has been no net gain in employment for the community's residents. The income benefit will not be the salary earned by the workers but the increase in salary to be earned at the new development.

Should the vacated job be filled by a locally unemployed worker there will be net increase in employment and income, and thus it should be counted as a local benefit.

This same analysis must also be applied to secondary employment and income. It is only a benefit if there has been a net increase in either the employment or income of the local residents.

The construction of a new industry in a community may have ramifications for the existing businesses. For instance, if a gas processing plant was built in an area where recreation and tourism were major industries these activities may suffer severe economic consequences. The demand for these recreational and tourist services will decline, as these uses are not compatible with gas processing.

Along with this decline comes a loss of income and employment in these sectors. The facility, having created jobs, has also destroyed some jobs and lowered some incomes. That is, the community has foregone some opportunities in the tourist industry to accept the opportunities attendant with a gas processing plant. When calculating the benefit of the new development the jobs lost must be subtracted from those gained in order to determine the net effect.

The jobs lost in other industries through the construction of the new facility should be classified as basic or non-basic. If they are basic then it is necessary not only to reduce the income and employment by the number of lost jobs, but also to calculate the multiplier effect in the downward direction. When a basic job is lost that opportunity to import income is lost.

The same multiplier calculated in Section I.B.7. may be multiplied by the decrease in basic jobs to obtain the total decrease in employment. A loss of non-basic employment can be subtracted directly from the estimated total impacts.

The opportunity costs outlined in this section are difficult to estimate. There are no precise empirical tools that can measure these impacts. There are several factors that will influence these events. If unemployment is low, there will be a smaller net increase in employment and income than if unemployment were high. If a local labor force has been underemployed, that is, working at jobs below their skill level, there is a greater probability that they will leave their present jobs for employment at the new development.

The effect on local industry may be apparent; in some cases the development may absolutely preclude a previous use. For example, if a pipecoating yard is placed on a beach and campground area the people employed at this area will definitely lose their jobs. This can and should be quantified and subtracted from total local benefit. The effect on related industries such as motels or restaurants will be difficult to quantify. If the analyst has good information about the specific establishments to be affected some estimate of the opportunity cost should be made. If no knowledge exists about adversely affected industries then no estimate can be made, but the qualitative effects should be documented.

II. THE PUBLIC SECTOR

A prominent issue of the development question for a local government will be the tax revenues and government expenditures which will result from facility construction. All the citizens in a community will be affected by this fiscal impact and thus it commands the greatest amount of attention. This section will discuss the quantifications of the fiscal impact in the public sector.

A. Revenues

In Connecticut 99% of an average locality's own-source revenue is derived from the property tax. The primary focus of revenues will, therefore, be on this tax.

1. Facility Revenue - The development will give rise to a tax revenue flow. The land, buildings and machinery are all revenue-producing. The figure most relevant to the local analyst will be the assessed value of the facility.

   a. A Specific Proposal - If a specific development proposal exists an estimation of the assessed value can normally be provided by the developer. The Department of Commerce reports that firms often provide this information to them along with financial flows and capital stock.

   b. A Hypothetical Development - One possible way to estimate the assessed value of a particular facility is to contact a locality where such a facility has recently been built and obtain a figure. If possible, a breakdown by land and structure should be provided as land values will be more variable than structure values.

   An alternative source would be industry representatives. They should be able to provide the town with an estimate based on the facilities they presently have operating. If they cannot provide the actual assessed value they could provide the town assessor with enough design information for him to make an estimate.

   The Department of Commerce could assist local planners in obtaining the needed information. The Connecticut Coastal Area Management Program may also be able to direct the analyst to information relating to OCS facilities and possibly other coastal industries. The town assessor can take this information on investment, equipment and site requirements and translate it into a rough valuation figure.

Having obtained an estimate of the assessed value of the facility the calculation of the tax revenues is a simple matter. The assessment ratio is applied to the assessed value and the mill rate is then applied to this figure to derive the actual revenues. The equation is:

$$(18) \quad V_f \, a \, r = T_f$$

where,

V_f = gross assessed value of facility
a = assessment ratio
r = mill rate
T_f = tax revenues generated by the facility

Once again the concept of opportunity cost must be invoked. The site and previous structure, if any, have generated tax revenues prior to the new development. Since the analyst should be concerned only with the increases in local tax revenues, this previous level of taxes must be subtracted from the estimated tax revenues generated by the new facility. This will produce the figure which reflects the increase in revenues.

2. Revenues from the Households - As was mentioned above, the Connecticut local governments derive 99% of their own-source revenues from the property tax. Population in-migration in most cases will increase local revenues through an expansion of the housing stock and automobile ownership. This section will outline the method by which the regional in-migration figure of the Private Sector section can be translated into a tax revenue estimate.

   a. Determining Local In-Migration - Primary regional in-migration was either given or derived in Section I.A.2.a. or Section I.A.2.b. This figure represents the number of employees moving into the region to work at the development. The secondary regional in-migration was estimated in Section I.B.8.a. or Section I.B.8.b. The sum of the primary and secondary regional in-migration represents the total in-migration induced by facility development. Some of the in-migrants will locate within the locality while others will locate in the non-local region. The number of these regional in-migrants taking residence within the locality becomes the relevant factor when estimating the public sector impacts.

An individual's residential location decision depends upon many variables. Proximity to work, proximity to a regional trade center, the size and variety of the housing stock, the cost of housing, the public services provided, the tax rate and personal preferences will influence the choice of location. The actual prediction of location patterns is still crude, even in the theoretical sphere and thus the analyst is forced to rely on less than ideal methods to derive local in-migration.

(1) Survey Methods - The first method would involve the surveying of people who are employed within the locality to determine the percentage of these employees who also reside within the locality. (This survey could be incorporated in the survey suggested in Section I.B.8.a.) This percentage should then be applied to the employment in-migrating to the region to determine the number actually taking up residence within the community. This method implies that the locational factors important to the past in-migrating persons will also be important to the new population moving into the region. If 70% of the present local employment resides within the locality then 70% of those in-migrating to the region to work at the facility or take secondary jobs within the locality will be assumed to locate within the locality.

An alternative method involves surveying local residents. The analyst could use this method if it were easier to survey local residents rather than local employees. The survey must establish the percentage of local residents employed within the community. This percentage is then applied to all local residents to estimate the total number of local residents working within the community. This figure when divided by total local employment is the percentage of persons employed in the community who also reside in the community. This is exactly the object of the first survey method. This figure is again applied to the regional in-migration of labor to derive the number of laborers who will reside within the locality.

The larger the sample the more accurate will be the estimate. The sampling for such a simple survey, as suggested here, would not be complicated and could be completed quickly and efficiently.

Once completed, the figures could be repeatedly applied to the fiscal impact model with only periodic updating. A survey, however, requires manpower and time, and thus adds cost to the initial use of the model. The accuracy of the analysis will be limited by the resources available to the analyst.

(2) A Non-Empirical Approach - If it is impossible to conduct a survey the analyst will be forced to make an assumption about the percentage of in-migrants who will locate within the community. The specific factors discussed in the residential decision calculus should be considered by the analyst. The distance to the facility and regional trade center, the size of the community and the tax and expenditure policy of local government should be examined with respect to locational patterns. The population increases following previous developments deserve review. Algebraically:

(19) $M_L = \phi M_T$

where,

M_L = in-migrating labor residing in locality

ϕ = percentage of local employment residing in locality

M_T = total in-migrating labor to region, primary and secondary

The coefficient ϕ now becomes the decision parameter. Its value is left to the analyst to estimate, based upon the relevant factors. It is best to choose a range for ϕ rather than a specific figure as this will reflect the uncertainty involved in this method. The analyst should also clearly delineate the factors considered in choosing the parameters. The Department of Commerce and Coastal Area Management Program could provide some guidance to the analyst in this choice. This method should only be used if the others are impossible to implement.

b. Housing Demands - After estimating the number of workers who will in-migrate to the town it will be necessary to estimate their demand for housing. It is reasonable to assume that each in-migrating worker represents a household. This assumption precludes the possibility of a husband and wife both being in-migrating workers and thus reducing the potential number of in-migrating households. It is not likely that this happens often enough to greatly bias the results.

The U.S. Census defines a household as "including all persons who occupy a group of rooms or a single room which constitutes a housing unit." Given the number of households, it remains to estimate the types of housing units these households will demand. There are two possible methods that can be used to project housing demands.

If the analyst is working from a specific development proposal, the best method to determine the mix of housing to be demanded would involve the examination of housing preferences of the labor force prior to in-migration. If the workers are being transferred it is likely that they will desire the same type of housing in their new location as they did previously. This information may be available from industry sources.

Another method would be to assume the new population will desire the same housing mix as presently exists in the region or locality. This should be tempered by examination of recent housing trends and the locality. For Connecticut the present mix is approximately 62.5% owner-occupied and 37.5% rental housing (source: Connecticut Department of Commerce, Connecticut Market Data - 1976). This same mix could be applied to the new households in the community. For example, assume the analyst has estimated 100 laborers in-migrating to the locality. This translates into 100 households and thus 100 dwelling units; 63 of these units will be owner-occupied and 37 will be rental units.

c. Housing Construction - The previous section described the estimation of housing demands (Section II.A.2.b.). These demands can be satisfied in two ways; through existing housing and through the construction of new housing. (Once the demands for owner-occupied and rental units have been determined the two markets should be studied separately.)

Estimating the housing construction induced by the increased number of households is not as easy as subtracting the number of vacant units from the number of units demanded. A certain level of excess capacity, in the form of vacant units, usually exists in both the owner-occupied and rental markets. It is, therefore, unrealistic to base housing construction on 100% capacity utilization of the local housing stock.

In most cases it will be correct to expect the housing demand to translate directly into construction. This will be particularly accurate if the markets are presently maintaining their normal excess capacity. (What "normal" excess capacity is will vary from place to place.) The increased demands are met, immediately, by the use of the excess capacity, but in the long run construction will take place to restore the normal excess capacity. This will not be true if the local housing market has suffered from vacancies over and above desired excess capacities. In this case housing demands may be partially satisfied through existing units in an attempt to return the market to its desired excess capacity.

d. Housing Tax Revenues - In translating the housing construction units into tax revenues the first step must be to estimate the assessed value of the additional housing stock. Local assessors or realtors should be able to provide an average assessed value for recently constructed owner-occupied and rental units. These averages can then be applied to the estimated number of units constructed in each category to get the increase in the grand list. From this point we return to a modified form of Equation (18):

$$(20) \quad V_h \, a \, r = T_h$$

where,

V_h = assesed value of the additional housing stock

T_h = tax revenues derived from the additional housing stock

Again the tax revenue estimated above is a gross figure; the opportunity cost must be subtracted. This would involve estimating the quantity of land needed to accomodate the expansion of the housing stock and then estimating the revenues generated by vacant land in the locality to develop a rough figure for previous revenues earned. The relevant figure is the tax revenue increase, above the revenues that would have been generated without the development.

e. Tax Revenues from Motor Vehicles - Motor vehicles are Connecticut's second largest source of household property tax revenues. In order to estimate the revenues generated by automobile ownership one first needs to know the average number of motor vehicles per household. Using this statistic the total number of vehicles accompanying the increased households may be estimated. Next, an average assessment should be applied to each vehicle from which the generated tax revenues may be derived. The equation form would be:

$$(21) \quad \Delta H \; U \; V_m \; a \; r = T_m$$

where,

ΔH = change in households
U = motor vehicles per household
V_m = average assessment per vehicle
a = assessment ratio
r = mill rate
T_m = total tax revenues from motor vehicles

Information of motor vehicle assessments by state, county or locality can be found in Information Relative to the Assessment and Collection of Taxes, published annually by the office of the Tax Commissioner as a state document. Connecticut Market Data - 1976 reports that there are presently 1.7 registered cars per household.

3. Total Tax Revenues - Total tax revenues will be the sum of the net tax revenues generated by the facility and the net tax revenues generated by the increased housing stock and motor vehicle ownership.

B. Public Expenditure

In addition to revenue generation, a new development and its induced growth will require public services and thus increased local expenditures. This section will outline the process to be followed in forecasting the expenditures required to meet the service demands of the facility and the increased population.

There are two major expenditure areas which are relevant to the analysis, depending upon the time period being examined, site preparation and annual operating and capital expenditures. It should be noted that site preparation expenditures are the direct result of the facility while annual operating expenditures are induced by both the facility and the population increase caused by the new development.

1. Site Preparation - If a facility privately purchases and develops a site which requires no local participation for any phase of facility location, this section does not need application.

During, or prior to, the construction phase a locality may prepare, or assist in preparation of a site for the facility. This typically takes place in an industrial park, although not necessarily. Access roads, sewers, water and electrical hookup must be extended to the site. Localities often finance the actual purchase and development of the industrial park itself. All local expenditures devoted to site improvement must be summed.

For a local analysis, if a portion of site development was federally or state funded this share should not be included as an expenditure. Only the share locally financed is relevant to a local analysis.

If the locality purchased the land which is used by the facility, any gains or losses in the sale of the site to the developer must be recorded. There may be a time framework disparity in this section of the analysis. Several years may pass between the time at which the sites in the industrial park were first purchased by the locality and the time when they were sold to the developer. These expenditures must be placed in a present value form to compare purchase and sale price. In the case of past expenditures the interest charge of previous purchases must be added.

This charge represents the opportunity cost of the money used by the town to purchase the site. For example, assume the locality purchases property five years prior to its actual sale. The money could, perhaps, have been invested in bonds yielding 7% annually or returned to the citizens, through tax cuts, so that they could have invested the money at 7% annually. This potential interest is what it costs the community to hold that property for five years. Thus, when comparing purchase and sale price when there has been a time lapse this cost must be added to the purchase price. A simple formula will provide the proper figures:

$$(22) \quad p_o \, \psi_{it} = P_t$$

where,

p_o = purchase price at time o
ψ_{it} = compound interest factor at interest i for t time periods
P_t = present value of purchase price at time t

The factor ψ_{it} is simply taken from financial tables. It is the amount, at compound interest, that one dollar will become at a certain interest rate and over a certain time period. It can also be calculated from:

$$(13) \quad \psi_{it} = (1 + i)^{t}$$

The choice of an interest rate is a complex subject which will not be fully explored in this report. The easiest route will be for the analyst to use that rate at which the community's funds could have been invested.

An example may demonstrate the importance of this procedure. Suppose a community purchased a parcel of land in 1971 for $9,000. In 1976 this site was sold to an industry for development at $10,000. It is tempting to assume the town has made a net gain of $1,000 in the transaction, but this is not true. The financial tables for 5 years and 7.5% interest yield a compound interest factor of 1.4356. Thus: $9,000 X 1.4356 = $12,920.40.

The present value of the site acquisition is $12,920.40, creating a $2,920.40 loss for the community which must be counted as an expenditure. This does not mean the site acquisition should not have been carried out; in those five years it may have gone to a less desirable use if it had not been purchased. It does indicate, contrary to appearances, that the course of action followed by the community cost $2,920.40.

It is unlikely that a facility will need the entire industrial park and thus the site expenditures will be in proportion to the amount of the park needed by the development. If the facility uses 25% of the park then 25% of the cost of developing the park should be allocated to this facility. All site specific expenditures are then added to this base share.

Industrial location experts at the Department of Commerce may assist local planners with cost estimates for site preparation. A local planner may have excellent information on these costs, particularly if the industrial park has already been developed.

For the specific site needs of a facility the analyst should consult the developer, if a specific proposal exists. If a hypothetical development is being postulated, industry sources, DOC or CAM, should be able to provide useful information.

2. Annual Local Expenditure - When the facility has been constructed the locality will begin to supply its bundle of public services to the facility and the increased local population. This will include such services as police protection, fire protection, waste collection and road maintenance. These are annual costs that continue for as long as the facility is in operation. Accompanying this bundle of goods and services will be increases in the local public budget.

   There are several methods that can be utilized to estimate increased expenditures on the local level. The choice of a method must depend upon: 1) the desired accuracy of the estimate, 2) the time and cost allocated to the analysis and 3) the local expertise available to aid in the preparation of the analysis.

   Three alternative methods will be presented for the estimation of increased public expenditures. Two of these methods will calculate the incremental, or marginal, cost of increased public sector output and one will calculate expenditures through the average costs. First, however, it will be necessary to calculate the increased demands for the public services.

   a. Service Demands - The first major step in calculating service demands will be the calculation of increased population and the increase in school age children. In Section II.A.2.a. the number of in-migrating workers, and thus households, was calculated. It will be necessary to translate the increased number of households into an increase in population. The number of persons per household is the statistic needed here. As with the estimate of housing demands, the most accurate method would involve a demographic profile of the employees of the industry moving into town. It has been assumed that each worker will represent a household. The number of persons per household should be multiplied times the number of in-migrating laborers working at the facility to yield an estimate of the increase in population caused directly by the facility.

      As was discussed previously, there will be in-migration due to secondary employment. The average number of persons per household for the state or region should be applied to the secondary labor in-migration as the analyst has no specific information on this population. The population estimate from primary and secondary labor are summed to derive total population increases.

If the analyst has no demographic data on the industry, the state or regional statistic can be applied to both the primary and secondary in-migrating labor without a great loss in accuracy. The Connecticut average is approximately 3.2 persons per household.

The same method should be used in the derivation of school age children. The number of school age children per household must be estimated. Again if industry specific information is available it should be applied to the primary in-migration with a general statistic applying to the secondary labor in-migration. The general statistic can be applied to total local in-migration given a lack of industry statistics. U.S. Census data will be a good source of general statistics. Having developed this information the analyst is ready to estimate the demands for public goods and services.

The facility itself creates increased service demands. The increase in developed property needs attendent increases in fire protection, police protection, sanitation and highways. These demands are due not only to the physical structure but also due to the commuters that are generated by the development.

Commuters are in the locality eight to ten hours a day. They heavily consume certain local expenditures while not consuming others at all. Highway and transportation services are particularly intensively used by commuters. Police, sanitation and sewage facilities are used to a lesser extent and education is not used at all.

The demand for services should be calculated by service sector. For example, the analyst, or expertise that can be enlisted by the analyst, may need to estimate the number of policemen , cars and office space necessary to provide protection to a $43,000,000 gas processing plant and the 80 new residents it generates. A local police official would most likely have certain service criteria that could be applied to this data. For example, a town may desire to have 3 policemen per thousand residents plus 1 policeman per $1,000,000 of assessed value. In addition 20 square feet of office space and 0.5 cars may be needed per policeman. Applying these standards to the new development the official can estimte the department's needs for manpower and capital facilities.

This same process should be followed by the analyst or local officials for each of the major service categories. The demands should be estimated for the complete scenario, including the needs of the facility plus the new population. The major departments in most towns would be:

1. Education department
2. Police department
3. Fire department
4. Sanitation
5. Sewage
6. Recreation and Parks
7. Highways and public works
8. Libraries
9. Water
10. Hospitals and Health
11. Welfare
12. General government

Income levels also play a role in determining the quantity and quality of public goods and services demanded by the citizens. In general, public service demands have grown faster than income. This means high income areas demand a higher level of services in proportion to their incomes than do low income areas. Thus influxes of population with incomes different than those existing within the locality may alter the demands on the public sector.

Changing income levels may also induce shifts in the composition of the local budgets. If incomes are increased then more may be spent on education or recreation and parks. If incomes are lowered then more may be spent on social services and health care facilities.

This model is not sophisticated enough to project how changing income levels may change service demands. This would require detailed econometric study, far beyond the abilities or needs of the present model. The importance of this factor is dependent upon how large a change in average income is to occur and how large a change there will be in the population. A 2% change in the population is likely to have little effect on service demands while a 50% change may have a substantial impact if the income levels are different. The analyst should be aware of this phenomenon, even if it is difficult to measure.

b. Full Marginal Cost Method - This method is the only theoretically correct method of assessing the increase in local expenditures due specifically to the facility and population. It is also the most difficult to calculate because it requires the most knowledge of public service costs. For each of the major service areas the analyst, or officials from the respective departments must calculate two scenarios. First, the minimum total annual cost of the service must be calculated, combing annual capital and operating costs, for the level of demand existing prior to the development. Next, the minimum cost of servicing the ex post level of demand, estimated in Section II.B.2.a. must be derived. It is the difference between these two that represents the true marginal cost of the development. It should be noted that this method does not consider the size or utilization of the present public facility. It merely calculates the difference in annual cost between two optimal facility sizes.

In the calculation of costs it must be remembered that the present set of calculations refers to an annual impact assessment. For this reason the capital costs must be amortized over the life of the facility, in order to obtain the annual capital cost. This is done:

$$(24) \quad k_o \, \Omega_{it} = K_t$$

where,

k_o = total capital cost of the facility
Ω_{it} = annuity whose present value is one at interest rate i for t years
K_t = annual capital cost

This annualized capital cost, K_t, must be summed with the operating cost to obtain the full annual cost associated with a particular size facility.

The logic behind this method is that a new development should not be penalized or aided by past decisions on public facility size. For example, suppose a solid waste facility has a capacity to handle 200 tons of material per day and is presently utilizing 150 tons per day of that capacity. The new development under consideration will generate 25 tons per day; still below the facility's capacity. One is tempted to calculate the increased expenditure as the cost of the additional manhours that will be necessary to process the additional 25 tons of waste. This, however, will underestimate the real cost of the expanded service. The capital cost of the increased waste processing was incurred prior to the development and thus has already been absorbed by past community residents. The new development will, however, consume capital. If the locality had not allowed further development it could have built a solid waste facility that processed 150 tons per day at a minimum cost. When the additional 25 tons a day was needed, disregarding past or future development, the relevant figure becomes processing 175 tons of waste per day at a minimum cost.

This method also prevents overestimation of the costs associated with a development. Suppose our new development had created 100 tons of waste per day. This requires 50 tons per day of capacity that does not exist. The cost of shipping this material to other waste disposal sites in the region will likely exceed the incremental cost of a waste facility designed to handle 250 tons per day at a minimum cost. Again, this facility should not be penalized because local planners could not anticipate this growth in demand or that older facilities are now reaching capacity. When local capacity is finally expanded, or if it is expanded immediately, it is likely that the new facility will have the ability to handle over 250 tons per day. This built-in excess capacity should not be charged to the development. Only the strict marginal cost should be assessed.

In calculating the marginal costs of providing the additional services to the facility and new population we are only interested in the costs to the locality. The federal and state grants to the locality, both general and specific, must be subtracted from the estimated costs. The incremental increase in specific grants should be subtracted from the departmental estimates while the incremental increase in general aid should be subtracted from the total expenditure figure.

The major drawback to this procedure is that it requires the analyst to estimate, or to have access to those who can estimate what the minimum facility cost will be for two given capacities.

This requires a great deal of knowledge about facility design, operation and costs. This method should be applied to each service category where the expertise exists to carry it out.

c. Modified Marginal Cost Method - If the expertise does not exist to calculate the full marginal cost, the modified marginal cost method makes a clear distinction between operating and capital costs.

Let us return to the first example of the previous section. There is a waste processing capacity of 200 tons per day and the new development is increasing throughput from 150 to 175 tons per day. The first step of this method calls for the estimation of increased operating costs. Local officials should be able to provide this information in manhours, physical inputs and energy cost.

The second step involves an estimate of the annualized capital cost of using existing capacity. While not an out of pocket expense, the use of excess capacity entails an opportunity cost. The resources devoted to the excess capacity in the solid waste facility could have been devoted to other public programs.

The new development is using 25 tons of the 200 ton capacity. Thus the new development should be alloted 12.5% of the annualized capital cost of the facility.

This procedure can also be used for calculating costs in the second example, when solid waste increases by 100 tons per day. The waste generation is now 250 tons per day, and thus requires a new facility. It is likely that the new facility will be built with some excess capacity in anticipation of future growth. Let us postulate the construction of a facility with 300 tons of processed waste per day capacity. In this case, 33.3% of the annualized capital cost must be allocated to the new development, as the new development was one-third of the total capacity.

The operating costs are calculated separately and are just the anticipated increase in the non-capital costs. The operating costs and annualized capital costs attibutable to the new development must be summed to obtain the total increased expenditure resulting from the development.

Again the anticipated state and federal contributions should be deducted from projected expenditure increases. After the total expenditure is calculated any increases in revenue-sharing should be deducted. This leaves increased local own-source expenditures.

d. <u>The Average Cost Method</u> - This is the most widely used, but least accurate method of estimating increased local expenditures. Unlike the two previous methods, the average cost method separately estimates expenditures for the facility, for in-migrating population and for educational expenditures.

The first step of this method involves separating non-educational budget items into those consumed jointly by business and households, and those strictly consumed by households. For instance, police and fire protection are consumed by both the businesses and the households in the locality. Recreation and parks, on the other hand, will be consumed only by the households.

For items consumed jointly by business and households the budget must be allocated between the two. This can be accomplished by assuming that the business sector consumes services in proportion to the percentage of assessed value which it comprises in the locality. For example, suppose that business property accounted for 15% of the local assessed value, then it will be assumed that for those items which it jointly consumes with households that 15% of the budgeted funds go to satisfy business demands. The other 85% is allocated to households. Thus, if the locality had a $100,000 highway budget, $15,000 would be allocated to business and $85,000 to households.

Next, the business portion of the budget is divided by the assessed value of business property. This establishes the dollars of public expenditure for business per dollar of assessed business value. When multiplied times the increase in assessed business value (i.e. the assessed value of the facility) we are left with the increased expenditure due to the facility for this particular budget item. The formula for this calculation is:

$$(25)\quad \frac{K_i}{BV} \times V_f = \Delta K_i$$

where,

K_i = public expenditure on item i for businesses
BV = total assessed value of businesses
V_f = assessed value of the facility
ΔK_i = change in expenditure on budget item i due to the facility

The increased expenditure on budget item i induced by the increased population must be calculated. To perform this calculation one takes the public expenditure for households per person and multiplies this times the increased population, in order to obtain the estimated public expenditure for the new population. Algebraically this is:

$$(26)\quad \frac{G_i}{D} \times \Delta D = \Delta G_i$$

where,

G_i = public expenditure on item i for households
D = local population
ΔD = change in local population
ΔG_i = change in public expenditure on item i due to the change in local population

Thus, K_i plus G_i represents the total increase in expenditure on item i, induced by both the facility and population. A numerical example may clarify how this procedure operates. Suppose we have a community with a grand list of $1,000,000 of which $150,000 worth is business related property. Next, suppose the highway budget, a jointly consumed item, is $100,000. As discussed above, this implies that the business share of highway expenditures is $15,000 and the household share is $85,000. Also, assume that the facility is assessed at $50,000 and will bring in 20 persons to a community with an existing population of 5,000. We can now form equations (25) and (26).

$$(25)\quad \frac{\$15{,}000}{\$150{,}000} \times \$50{,}000 = .1 \times \$50{,}000 = \$5{,}000$$

$$(26)\quad \frac{\$85{,}000}{5{,}000} \times 20 = \$17 \times 20 = \$340$$

The total increase in highway expenditures is $5,340.

This process is repeated for each non-educational item in the budget. For those items consumed completely by households one uses only equation (26). In those cases G_i is just the entire budget for item i. It should be stressed that state and federal funds should be subtracted from the budget items prior to the allocation. We are attempting to derive average <u>local</u> expenditures and thus must net out non-local funds.

The educational budget, by far the most important item in nearly all local budgets, remains to be estimated. This is simply obtained by taking per pupil expenditure, remembering to subtract out non-local educational funds from the total educational budget, and multiplying it times the estimated increase in the number of students. The simple equation will be:

$$(27)\quad \frac{J}{S} \times \Delta S = \Delta J$$

where,

J = the local educational expenditure
S = total number of pupils
ΔS = the change in the number of pupils
ΔJ = the change in local educational expenditures

The sum of the changes in expenditures on all budget items represents the increase in total local public expenditure.

This method is very attractive due to the ease with which the estimates can be made. It requires no expertise and uses data that is readily available for all localities.

This method is not without its serious drawbacks, however. The assumption that each child or person adds the same expenditure as the average of all the previous persons totally circumvents a major issue, the capital capacity problem. The capital facilities used to aid in the production of public services will in most cases have differing average costs depending on their required sizes. Economies of scale becomes an important concept. An economy of scale implies that the larger the facility becomes the lower the cost per unit of output. This would mean that the costs would not rise as rapidly as the demands generated by the new population. For example, sewage treatment plants exhibit economies of scale over larger ranges of output.

Diseconomies of scale means just the opposite; increasing size increases the unit cost. This is more prevalent in operating costs. Often as staff size increases the administration costs of coordinating large numbers of employees increases at a greater rate than actual output is increasing. The average cost technique ignores this issue completely.

It also will not alert the analyst to possible new public facility construction necessitated by the development. A new high school or fire station may be needed if their capacities are exceeded but there will be no way to discern this from the analysis performed above. If this method is to be used the analyst is strongly urged to display capacities for the major public facilities before and after the development. This will not properly quantify the costs, make them more accurate, or estimate economies or diseconomies of scale in production, but it will signal the analyst as to the effect the new development will have on the capacity of the public facilities.

e. Combining Methods - The three methods of expenditure estimation are not mutually exclusive. The best method possible should be used for each service category. For example, the analyst may have access to expertise that can use the full marginal cost method for education and police expenditure. The fire and highway department may only be able to use the modified marginal cost method, while the analyst, lacking access to expertise in the sewage and solid waste sectors, may be forced to use the average cost method.

There are no problems in mixing the use of methods. The greater the use of better methods the more accurate will be the final estimate of total local public expenditure.

3. Total Expenditure - Total expenditure for the time period being studied must be summed. In the preliminary stages this would be site preparation expenditures plus any services being provided or expanded by the locality at that time. In later years the total expenditure would include the annual expenditures of all the public sectors.

C. The Revenue - Expenditure Balance

Having derived total local revenues and total local expenditures for a single time period, the analyst may wish to examine the net effect for that period:

(28) Total Revenues - Total Expenditures = Net Revenue

Net revenues, or the revenue-expenditure balance, may be positive or negative.

Positive and negative net revenue impacts will induce further adjustment in the locality's fiscal structure. It is illegal for localities in Connecticut to run budget deficits and very few wish to sustain large surpluses over time. A positive net revenue will allow the locality to increase public expenditures or decrease tax rates. A negative net impact, on the other hand, will force a decrease in the quantity or quality of public services or an increase in the tax rate. This paper makes no attempt to forecast how the net revenue-expenditure balance will be handled; this is a question that will be dealt with in the political sphere. The calculations made with this model hold the tax rate constant and project expenditures based on the current quality standards of the community.

It should be stressed that a positive or negative net revenue impact does not imply a net revenue gain or loss for the development over the entire life of the project. The analysis, thus far, has examined only a single time period. The next section of the paper will present the procedure to be used in combining different time periods.

INTERTEMPORAL IMPACT ASSESSMENT

The previous section of this paper presented a modeling technique to estimate local fiscal benefits for the private and public sector in a single time period. This section will attempt to define a method that can combine and compare impacts in different time frames. The primary concern will be with the revenue - expenditure balance, although a method of application will also be given for the private income benefits.

I. ANNUAL IMPACT ASSESSMENT

A net revenue benefit in a particular period does not necessitate a net revenue benefit throughout the life of the project. The fiscal picture will change as the project moves from site preparation to construction to operation. It is possible that there will be a negative net revenue benefit during the construction of the facility but that as the operations phase begins a positive revenue benefit is produced.

The analyst must be able to compare differing impacts across the span of time if the total effect of the project is to be judged. As demonstrated in Annual Analysis Section II.B.1. dollar values from different time periods cannot be directly compared. In order to assess the complete impact the period analysis should be brought to a common time frame. Figure 3 depicts the effects of a hypothetical development.

Large negative net revenues are incurred by the locality for seven years followed by 25 years of a moderate positive net revenue. The analysis takes place in 1976. The first expenditures were initiated in 1971 for site acquisition and preparation. From 1976 to 1978 the facility is under construction and between 1978 and 2003 the facility is in operation. After 2003 the facility is scheduled for shutdown. The net impact for each of these years must be put in present value form. Two different techniques must be used depending upon whether the impact is in a previous time period or in a future time period. Obviously impacts occurring during the year of the analysis remain as estimated.

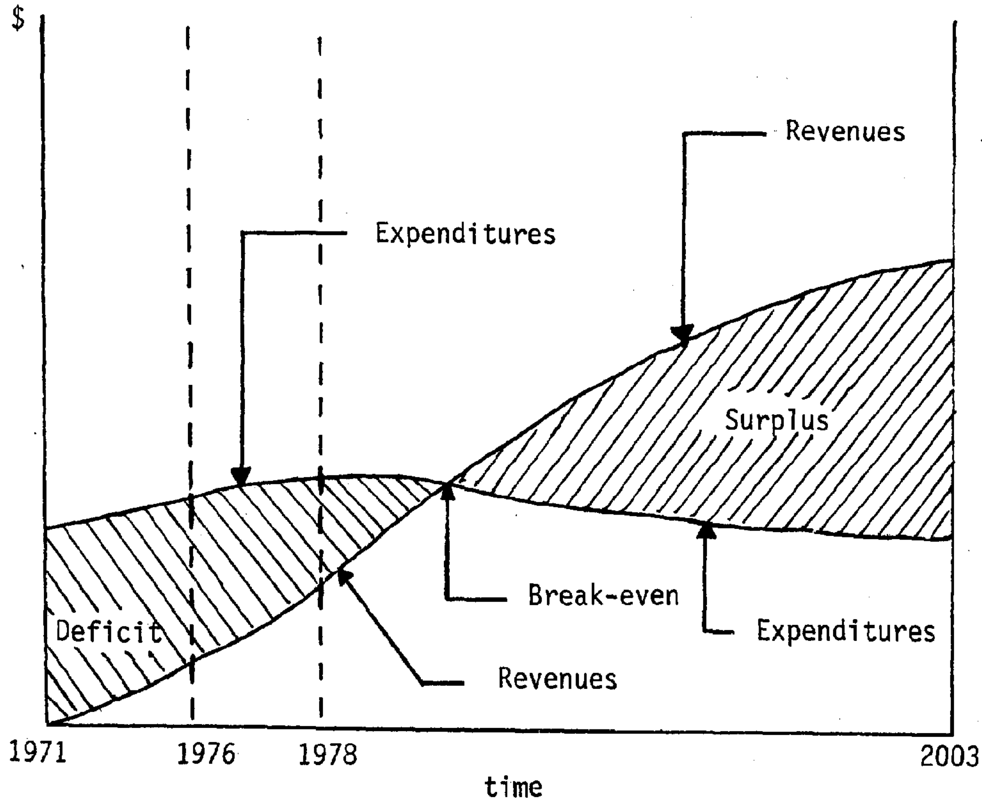

FIGURE 3

Hypothetical Revenue - Expenditure Stream

A. Present Value of Previous Impacts

This method is just a different variety of that described in Annual Analysis Section II.B.1. The equation is:

$$(29) \quad b_t \, \psi_{it} = B_t$$

where,

b_t = revenue - expenditure balance of year t
B_t = present value of revenue - expenditure balance for year t
ψ_{it} = compound interest factor for t years at interest rate i

This process should be repeated for each year there were impacts prior to the time of the analysis. The sum of the present values of all past balances should be taken.

B. Present Value of Future Impacts

Future impacts must be discounted to present values for the analysis. The necessity of this procedure can be easily seen with an example. Given a choice of one dollar today and a dollar ten years hence the individual will choose the dollar today. The reason is that a dollar today can either be used immediately or invested. If it is invested, in 10 years it will be worth well over one dollar. Thus it can be seen that dollars in the present are worth more than those in the future. For this same reason net revenue gains or losses occurring in the future will have a reduced value when discounted to the present. The procedure is again a simple one:

$$(30) \quad f_t \, W_{it} = F_t$$

where,

f_t = revenue-expenditure balance in future time period t
W_{it} = present value factor for time t and interest rate i
F_t = present value of future revenue-expenditure balance for time period t

The present value factor W_{it} can be found in present value financial tables, or for annually compounding interest the formula is:

$$(31) \quad W_{it} = \frac{1}{(1+i)^t}$$

Suppose that in ten years the time period analysis indicates a positive net revenue of $2,000. The analyst must now estimate the present value of this $2,000. For ten years and assuming an interest rate of 6.5%, W = .5327. This means that a dollar ten years in the future is identical to $.5327 today, at the 6.5% rate of interest. So:

$2,000 X .5327 = $1,065.40

This process is repeated for each of the future years of analysis. The method applies equally to positive and negative revenue-expenditure balances. These individual annual figures are then summed.

C. <u>The Total Intertemporal Revenue-Expenditure Balance</u>

Three separately derived figures must now be summed to get the final intertemporal balance:

$$(32) \quad \Pi\, B_t + C + \Pi\, F_t = R$$

where,

$\Pi\, B_t$ = sum of present values of previous balances
C = balance in current year
$\Pi\, F_t$ = sum of present values of future balances
R = total intertemporal balance

The total balance is the figure relevant to the local decision-maker. It will indicate whether, over the life of the development, tax revenues generated by the development exceed, equal or fall short of the needed public expenditures.

II. AN ABBREVIATED INTERTEMPORAL METHOD

The method outlined above will yield the most accurate results and should be followed whenever possible. It may be difficult or impractical, however, for the analyst to apply the fiscal impact analysis to as many as thirty time periods.

Most developments move through three distinct stages; site preparation, construction and operation.

This would imply the time diagram in Figure 3 would look like Figure 4.

If the impacts are homogeneous within each of these phases the analyst can derive the total balance by estimating impacts only once for each phase. For example, during site preparation there may be three years of a \$3,000 negative balance. The analysis for the three year construction period may indicate a \$4,000 negative balance. During a representative operation year there may be a \$1,000 positive balance, occurring over the twenty years of operation. Having made these three estimates the analyst can go directly to transforming them into present values.

A. The Present Value of Previous Balances

A recurring annual impact is essentially the same as an annuity. To get the present value of this three year constant stream we use:

$$(33) \quad b_A \, \delta_{it} = B_A$$

where,

b_A = annual balance
B_A = present value of the stream of annual balances
δ_{it} = amount of annuity factor for t years at interest rate i

Financial table are readily available for the "amount of annuity factor", δ_{it}. The δ_{it} can also be obtained from:

$$(34) \quad \delta_{it} = \frac{(1+i)^t - 1}{i}$$

For the example postulated above, with t = 3 and i = .065, 3 year at interest rate of 6.5%, the δ_{it} = 3.1992 and thus we calculate:

$3,000 X 3.1992 = $9,597.60

The present value of this previous three year negative balance is, therefore, a negative $9,597.60.

B. Present Value of Future Balances

The present value of future balances can be derived by using the "present value of an annuity" concept. This essentially estimates the present value of a constant stream of future dollars. The formula will be:

$$(35) \quad f_A \, \xi_{it} = F_A$$

where,

f_A = future annual balances
F_A = present value of future balances
ξ_{it} = present value of an annuity for t years at interest rate i

For t = 3 and i = .065 then ξ_{it} = 2.6484. This means a flow of one dollar a year for the next three years is equal to $2.6484 today. For the example above, the analyst applies this procedure to the construction impacts:

$4,000 X 2.6484 = $10,593.60

Thus the present value of the three year negative balance impact is a negative $10,593.60.

There will be two steps in calculating the present value of the 20 year, $1,000 operation net revenue balance. The first step will be to convert the twenty year flow to a present value using the procedure just outlined above. Using t = 20 and i = .065 we find ξ_{it} = 11.0185 and thus:

$1,000 X 11.0185 = $11,018.50

This is step one as seen in Figure 5; it reduces the annual flows to a single sum. It is not yet, however, a true present value, for the estimated value is still three years in the future.

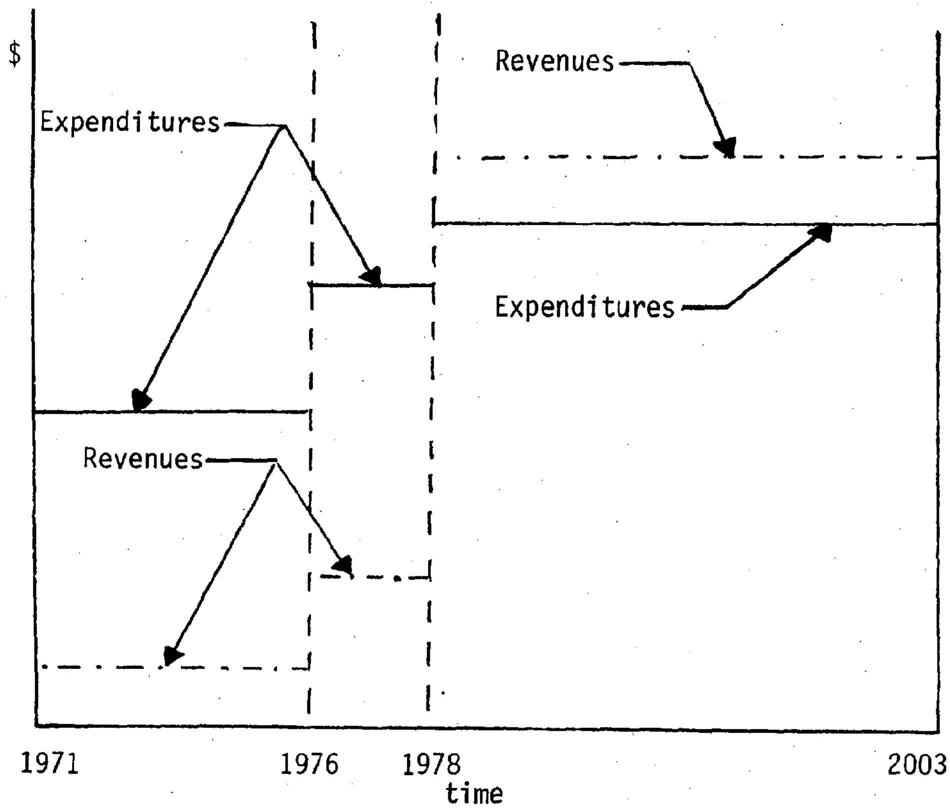

FIGURE 4

Revenue - Expenditure Stream by Phases

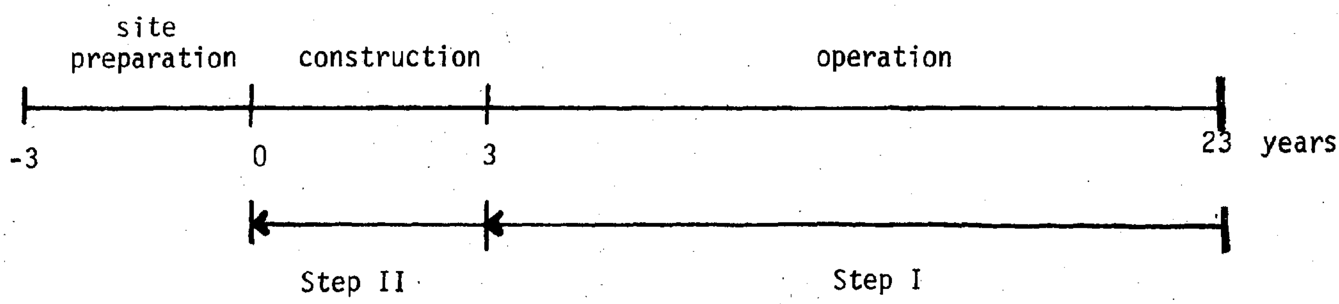

FIGURE 5

Stepwise Calculation of Present Value

The analyst simply uses equation (30) to convert this figure into a present value. For t = 3 and i = .065 the W_{it} = .8278 and so:

$$\$11{,}018.50 \times .8278 = \$9{,}121.11$$

Thus the present value of the twenty year $1,000 annual positive balance is $9,121.11. This is shown as Step II in Figure 5.

C. <u>The Total Intertemporal Balance</u>

The total intertemporal balance of this hypothetical development is the sum of the balances of all three phases. This is:

$$(-\$9{,}597.60) + (-\$10{,}593.60) + (\$9{,}121.11) = -\ \$11{,}070.09$$

Over the twenty-six year life of this development the community will lose $11,070.09 in tax revenues.

This method sacrifices accuracy by lumping twenty-six years of impacts into three groupings. However, its computational simplicity makes it very attractive, particularly when impacts can easily be categorized into the three phases outlined above.

III. THE PRESENT VALUE OF THE INCOME FLOW

Determining the present value of the income stream is not as crucial as with the revenue-expenditure balance. In the case of the latter, the analyst is dealing with both positive and negative elements which must be compared, while in the former case the stream is always positive and thus so will its present value.

If the analysis is being carried out to estimate the impacts for each year then it is appropriate to use the present value method used in Intertemporal Section I.B. In equation (30) the analyst must replace the revenue-expenditure balance in period t, f_t, by the total income flow in period t, y_t. Applying the appropriate present value factor W_{it}, one can derive the present value of the future income flow, Y_t. This is repeated for each year of the analysis and the present value of the incomes are summed to a figure representing the total income earned over the course of the development.

If the analyst is estimating impacts by phase, the annuity method is the most efficient process. It will be necessary only to examine the construction and operation phases, as site preparation and acquisition just involves devoting public resources for development rather than true income generation for local residents. This method is identical to that of Section II.B. The annual income flows are estimated for each phase. The present value of the construction impacts is simply calculated using Equation (35) and replacing f_A by y_A, annual income flows,and F_A by Y_A, the present value of the annual income flow. The operations impact must be calculated using the two stage procedure given for the present value of the operations balance. The annual income flows replace the annual balances in the calculation of the present values.

SUMMARY OUTLINE OF THE FISCAL IMPACT MODEL

The following is a step by step outline of the fiscal model just presented. It may be helpful in gaining a sense of the flow of the model and can be used as a check in the preparation of the analysis.

SECTION 1: ANNUAL ANALYSIS

I. THE PRIVATE SECTOR

Step I: Primary Private Benefits

A. Find or estimate total employment and/or income.

Sources:
1. the developer
2. Department of Commerce
3. Coastal Area Management Program
4. Industry sources
5. Previous studies
6. Average firm size

B. Estimate local employment and/or income.

1. Find or estimate in-migration to region, M.
   sources: 1-5 of above

2. Derive regional employment.
   (3) $L + R = T - M$ (ref. p. 1-3)

3. Estimate local labor demand.
   (4) $L_d = \gamma(T-M)$ (ref. p. 1-5)

4. Compare local labor demand, L_d, against available local labor.

5. Establish actual local employment and income estimate.

Step II: Secondary Private Benefit

A. Determine whether local or county data is to be used.

B. Determine basic industries with the location quotient.

$$(9)\quad L_i = \frac{ei/e}{Ei/E} \qquad \text{(ref. p. 1-11)}$$

C. Determine total basic employment.

1. Method I - sum all employment or income in industries with $L_i > 1$.

or

2. Method II - only consider basic employment as the percentage above the national average.

$$(10)\quad B_i = e_i - \frac{E_i}{E}e \quad \text{for } B_i \geq 0$$

sum the B_i (ref. p. 1-12)

D. Calculate the Multiplier.

1. Averaging Method, form the following ratios for N periods.

$$(11)\quad \frac{T_1}{B_1} = \lambda_1,\ \frac{T_2}{B_2} = \lambda_2, \cdots, \frac{T_i}{B_i} = \lambda_i, \ldots \frac{T_N}{B_N} = \lambda_N \quad \text{(ref. p. 1-13)}$$

take average of all λ_i to get λ ,

or

2. Regression analysis.

$$(12)\quad T_t = a + \lambda B_t \qquad \text{(ref. p. 1-13)}$$

E. Determine the total secondary flow.

1. Use of local data.

a. Determine the basic employment at the new facility.

(1) Method I - assume it is all basic

(2) Method II - use:

(10) $B_i = e_i - \frac{E_i}{E} e$ for $B_i \geq 0$ (ref. p. 1-12)

b. Apply the multiplier.

(8) $\Delta T = \lambda \Delta B$ (ref. p. 1-14)

c. Derive the secondary flow.

(7) $\Delta T - \Delta B = \Delta NB$ (ref. p. 1-14)

d. Deduct in-migration.

(1) Survey Method - find percent of the workforce that in-migrated to get the job they presently have, Θ, then:

(13) $(1-\Theta)\ \Delta NB = \Delta NB_r$ = non-basic regional employment (ref. p. 1-15)

or

(2) Assignment Method - assign range of values to Θ

e. Secondary flow for local residents. Assume $\Delta NB_r \doteq$ local benefit.

f. Deduct the opportunity cost.

2. Use of county data.

a. Determine the basic employment at the new facility, methods same as in use of local data.

b. Apply the multiplier.

(14) $\Delta T_c = \lambda_c\ \Delta B_c$ (ref. p. 1-17)

c. Derive the secondary flow.

$$(15) \quad \Delta T_c - \Delta B_c = \Delta NB_c \quad \text{(ref. p. 1-18)}$$

d. Estimate employment within the locality.

$$(16) \quad \Delta NB_c \quad \frac{T_L}{T_c} = \Delta NB_L \quad \text{(ref. p. 1-18)}$$

e. Deduct in-migration - use methods in Step II.E.1.d., in form:

$$(17) \quad (1-\Theta)\,\Delta NB_L = \Delta NB_r = \text{non-basic regional employment} \quad \text{(ref. p. 1-18)}$$

f. Secondary flow for local residents. Assume ΔNB_r = local benefit.

g. Deduct opportunity cost.

II. THE PUBLIC SECTOR

Step III: Revenue from Facility

A. Find or estimate assessed value sources: 1-5 of Step I.A.

B. Estimate tax revenues from facility.

$$(18)\quad V_f \; a \; r = T_f \qquad \text{(ref. p. 1-22)}$$

Step IV: Revenues from Households

A. Determine local in-migration.

1. Survey local employees, or
2. Survey local residents, or
3. Estimate ϕ:

$$(19)\quad M_L = \phi M_T \qquad \text{(ref. p. 1-24)}$$

B. Determine housing demands of M_L.

1. Number of units demanded.
2. Mix of housing.
   a. Use profile of industry employees, or
   b. Use regional or local housing mix.

C. Determine housing construction.

D. Derive housing tax revenues.

1. Estimate assessed values using average assessed values of recently constructed units.

2. Estimate tax revenues.

$$(20)\quad V_h \; a \; r = T_h \qquad \text{(ref. p. 1-26)}$$

E. Derive tax revenues from motor vehicles.

$$(21)\quad \Delta H \uplus V_m \; a \; r = T_m \qquad \text{(ref. p. 1-27)}$$

Step V: <u>Derive Total Tax Revenue</u>

The sum of Step III.B., Step IV.D.2. and Step IV.E.

Step VI: <u>Estimate Site Expenditures</u>

A. Estimate expenditures for site preparation.
   Sources: 1-5.

B. Determine net expenditure on site acquisition - use compound interest method if purchase and sale occur at different times.

$$(22)\quad p_o\, \psi_{it} = P_t \qquad \text{(ref. p. 1-28)}$$

C. Total site expenditures.
   Sum Step VI.A. and Step VI.B.(If time period being analysed is post-site preparation, utilize Step VII

Step VII: <u>Estimate Annual Local Expenditure</u>

A. Estimate service demands.
   1. Find or estimate demands of facility.
      Sources: 1-5 of Step I.A.

   2. Derive population increase.
   3. Derive school-age children.
   4. Estimate service demands by sector:
      a. education
      b. police
      c. fire
      d. sanitation
      e. sewage
      f. recreation and parks
      g. highways and public works
      h. libraries
      i. water
      j. hospitals and health
      k. welfare
      l. general government

B. Estimate local expenditures.
   1. Full marginal cost method, or
   2. Modified marginal cost method.
      a. increased operation costs
      b. the percentage of the capital facility utilized
      c. total local expenditure

or

3. Average cost method.
   a. divide budget items into two categories:
      (1) those consumed by businesses and households
      (2) those consumed only by households
   b. for those items consumed jointly calculate:

$$(25) \quad \frac{K_i}{BV} \times V_f = \Delta K_i \qquad \text{(ref. p. 1-37)}$$

$$(26) \quad \frac{G_i}{D} \times \Delta D = \Delta G_i \qquad \text{(ref. p. 1-37)}$$

   c. sum a. and b. for each item i.
   d. for those consumed by households only:

$$(26) \quad \frac{G_i}{D} \times \Delta D = \Delta G_i \qquad \text{(ref. p. 1-37)}$$

   e. sum K_i and G_i for all budget items to derive total increase in non-educational expenditures.

   f. calculate educational expenditures:

$$(27) \quad \frac{J}{S} \times \Delta S = \Delta J \qquad \text{(ref. p. 1-38)}$$

   g. sum e. and f. to arrive at total increase in the local budget.

Step VIII: Total Annual Local Expenditure

Step VI.C. or Step VII.B.

Step IX: The Revenue-Expenditure Balance

Step V minus Step VIII

SECTION 2: INTERTEMPORAL IMPACT ASSESSMENT

I. ANNUAL IMPACT ASSESSMENT

Step X: Estimation for Annual Impact Assessment

A. Derive present value of previous impacts.

$$(29) \quad b_t \, \psi_{it} = B_t \qquad \text{(ref. p. 2-3)}$$

B. Derive present value of future impacts.

$$(30) \quad f_t \, W_{it} = F_t \qquad \text{(ref. p. 2-3)}$$

C. Repeat Step X.A. and/or X.B. for each year of impacts.

D. Total revenue-expenditure balance.

$$(32) \quad \Pi B_t + C + \Pi F_t = R \qquad \text{(ref. p. 2-4)}$$

II. AN ABBREVIATED INTERTEMPORAL METHOD

Step XI: Estimation for Abbreviated Method

A. Present value of previous balances.

$$(33) \quad b_A \, \delta_{it} = B_A \qquad \text{(ref. p. 2-5)}$$

B. Present value of future balances.

$$(35) \quad f_A \, \xi_{it} = F_A \qquad \text{(ref. p. 2-6)}$$

C. The total intertemporal balance.

III. THE PRESENT VALUE OF THE INCOME FLOW

Step XII: Estimate Present Value of Income Flows

Repeat Step X or Step XI replacing revenue-expenditure balance with annual income (optional).

SOME FINAL CONSIDERATIONS

Economic models are simplified abstractions of a complex set of economic factors. They are not designed to fully represent a working economy, with the multitude of interrelated elements that affect the daily functioning of an economy. This model is no exception. It has isolated three major areas for analysis; income and employment in the private sector and the revenues-expenditure balance in the public sector. These are just three of the many factors that a local decision-maker must consider in assessing the total impact of a development. This model is meant as an aid and should only be used as such.

The accuracy of the results that will be obtained by using this model will depend on several key factors. The first is the validity of the assumptions that are made throughout the report; some are built into the model while others are left to the analyst. A conscious attempt has been made to force an explicit presentation of assumptions. Those assumptions built into the model are noted in this study while those left to the analyst often require a value to be assigned to a parameter. This method allows the analyst, or those reviewing the analysis, to gain an understanding of the sensitivity of the results to the assumptions. It may also point to any biases in this model, or in the parameters of the analyst.

Accuracy will also depend upon the availability of reliable data on which to build the analysis. Data may be very good on specific development proposals, as the developers will normally have gathered much of the relevant data. A hypothetical scenario is subject to less precise data and thus the results may suffer from inaccuracy. The better the data the analyst begins with the better will be the results.

This model often allows the analyst a choice of possible estimation techniques. In most cases the techniques vary in their degree of precision. The results will obviously improve with the use of the more accurate methodology.

Perhaps the most important element in conducting the analysis is familiarity with the model. Several key parameters need be estimated only once to be repeatedly used in different fiscal studies. For example, once a local multiplier has been derived it can be used to estimate impacts for any local development needing only periodic updating. The analyst will also become more acquainted with the particular factors important within the community. Familiarity with the model itself will facilitate its application and perhaps point to areas that need adjustment for utilization in a locality. The more the model is used the better the model and its results will become.

It is hoped that this model will be used by those interested in fiscal impact analysis. With its use will come improvement and thus further enlightenment in understanding the complex economic factors affecting local development.